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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/893,866	06/28/2001	Apostolos Voutsas	SLA 0592	5636

7590 07/31/2002
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EXAMINER

SARKAR, ASOK K

ART UNIT	PAPER NUMBER
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2829

DATE MAILED: 07/31/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/893,866

Applicant(s)

VOUTSAS, APOSTOLOS

Examiner

Asok K. Sarkar

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 6/18/02
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Objections

1. Claims 6, 19 and 22 are objected to because of the following informalities:

In claims 6, 19 and 22, "5 X e¹⁷ atoms/cm³" should be replaced by 5 X 10¹⁷ atoms/cm³.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. Claims 1 – 3, 12 and 14 rejected under 35 U. S.C. 102(b) as being unpatentable for reasons of record in Paper No. 3 is reproduced below:

3. Claims 1 – 3, 12, 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Zhang, US 5,569,936.

Zhang teaches a method of fabricating LCD device comprising:

- forming a target including silicon and a first concentration of first impurity (in column 3, lines 60 – 65) of transition metals such as Ni (in column 3, lines 50 – 53)
- supplying a substrate 10 with reference to Fig. 1.
- sputter depositing an amorphous Si film on the substrate with a controlled amount of second concentration of the impurity.

Claim Rejections - 35 USC § 103

4. Claims 4, 5, 11, 13, 15 and 16 – 18 rejected under 35 U. S.C. 103(a) as being unpatentable for reasons of record in Paper No. 3 is reproduced below:

5. Claims 4, 5, 11, 13, 15, 16 – 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang, US 5,569,936.

Zhang teaches forming the amorphous silicon film from a composite target of Si and impurity Ni having concentration of 10^{17} atoms/cm³ in between column 3, line 46 and column 4, line 17.

Zhang fails to expressly teach forming the Si target with single crystal silicon and first Ni concentration of 0.01 – 0.5 atom% and then depositing an amorphous Si film containing a second Ni concentration.

However, it would have been obvious to one with ordinary skill in the art at the time of the invention to form the amorphous film with a second Ni concentration from a composite target of single crystal silicon and first Ni concentration of 0.01 – 0.5 atom% since amorphous Si will be produced by sputtering from any type of Si target so long as the substrate temperature is not too high to crystallize it. Moreover, it would have been obvious to one with ordinary skill in the art at the time of the invention to judiciously adjust and control these parameters during the crystallization of an amorphous silicon film to form the TFT of appropriate performance characteristics through routine experimentation and optimization to achieve optimum benefits (see MPEP 2144.05) and it would not yield any unexpected results.

Note that the specification contains no disclosure of either the critical nature of the claimed processes or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen methods or upon another variable recited in a claim, the Applicant must show that the chosen methods or variables are critical

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(*Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir., 1990)). See also *In re Aller, Lacey and Hall* (10 USPQ 233 – 237).

6. Claims 6, 8, 9, 19, 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang, US 5,569,936 in view of Yamazaki, US 6,306,694.

Zhang teaches a method of crystallizing amorphous Si film by sputter deposition from a composite target of Si and transition metal.

Zhang fails to expressly teach adding a third concentration of P in the target to deposit the Si film with a fourth concentration of P sufficient to create a V_{th} shift (threshold votage) in the Si film (claims 6 and 19). Zhang also fails to add a first concentration of Ge to the composite sputtering trgaet of Si to form amorphous Si film containing second concentration of Ge in the film (claims 8, 9, 21 and 22) and then adding a fourth concentration of P in the composite target to control the threshold votage of the Si film (claims 9 and 22).

Yamazaki teaches that besides Ni, Ge can also be used as a crystallization catalyst for amorphous Si in column 7, lines 37 – 42. Yamazaki further teaches channel doping with n-type dopants such as P in column 4, lines 13 – 33 for controlling threshold voltage.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Zhang's teaching to form the amorphous film with a second Ni concentration and P concentration from a composite target of silicon and first Ni concentration and third concentration of P or amorphous film with a second Ge concentration and appropriate P concentration from a composite target of silicon and

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first Ge concentration and third concentration of P as taught by Yamazaki, since amorphous Si can be crystallized by adding Ge catalyst and presence of appropriate amount of P within the Si film will create the first V_{th} shift for the TFT device. Moreover, it would have been obvious to one with ordinary skill in the art at the time of the invention to judiciously adjust and control these parameters during the crystallization of an amorphous silicon film to form the TFT of appropriate performance characteristics through routine experimentation and optimization to achieve optimum benefits (see MPEP 2144.05) and it would not yield any unexpected results.

7. Claims 7, 10, 20 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang, US 5,569,936 in view of Yamazaki, US 6,306,694 as applied to claims 1, 3, 12 and 16 above, and further in view of the Admitted prior Art (APA).

Regarding claims 7 and 20, Zhang in view of Yamazaki teaches about sputtering but fails to expressly teach pulsed or non-pulsed DC sputtering.

The APA teaches DC sputtering in page 5, line 4.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Zhang's teaching to form the amorphous film by pulsed or non-pulsed DC sputtering from a composite Si target since pulsed DC sputtering is a common method of sputtering semi-insulating materials.

Regarding claims 10 and 23, the APA teaches forming the impurity silicide by annealing in page 2, lines 1 – 5 by low and high temperature annealing.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention that crystallization of Zhang's film will occur through the intermediate formation of Ni-silicide during the annealing process.

Response to Arguments

8. Applicant's arguments filed June 18, 2002 have been fully considered but they are not persuasive.

9. Regarding the Applicant's arguments about claims 1 and 12 that Zhang does not teach adding Ni catalyst to a sputtering target, the Applicant is directed to Zhang's column 3, lines 60 – 65, (the Applicant acknowledges this in their response) where he teaches that catalyst can be added to the sputtering target irrespective of not using the process in their embodiments.

In regard to the difference in catalyst concentration in the target and in the film, it is well known in the sputtering process that due to the difference in the sputtering yields of different materials within the target, the film composition is different from that of the target. See for example, Chapter 5, page 183 of "Deposition Technologies for Films and Coatings" by R. F. Bunshah, Noyes Publications, NJ, U.S.A. (1982).

Similarly, in light of Zhang's teachings, it would be obvious to a person skilled in the art to form the target with required amount of catalyst element in a single crystal Si target since it is well known in the art that sputtering from single crystal Si target will produce an amorphous Si film so long as the substrate temperature is not high.

Regarding the reference of Yamazaki, Yamazaki also teaches that Ni can be used as a catalyst for crystallizing amorphous Si and also teaches P doping for controlling threshold voltages of the TFT.

There are various forms of sputtering and DC sputtering process is well known in the industry.

10. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988), and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the use of a sputtering process, target composition and material characteristics are well known in the semiconductor industry.

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

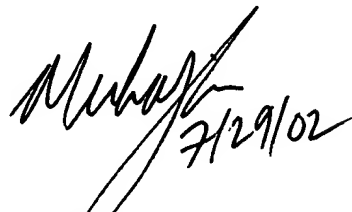
extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 703 308 2521. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael J. Sherry can be reached on 703 308 1680. The fax phone numbers for the organization where this application or proceeding is assigned are 703 308 7722 for regular communications and 703 308 7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 4918.

Asok K. Sarkar
July 29, 2002


MICHAEL SHERRY
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